US energy policy

The US doesn't have a coherent "energy policy" per se. Rather, it has a large array of interconnected laws, regulations, market systems, leasing arrangements, tax provisions, etc. affecting the production, refining, distribution and sale of various fuels in various uses.

The US started out with firewood as its primary fuel, shifted to coal during its 19th-century industrialization, then to oil in the 20th century. Recent decades have seen natural gas gradually displacing oil, and growing investments in a number of alternative energy systems: nuclear, hydro, wind, solar, ethanol, etc. The general objectives of US energy policy are to insure that future energy supplies will be stable and affordable, with diminishing environmental impacts.

Electricity

The largest sector of the US energy economy is electricity. In 2010, the US generated its electricity from coal (45%), natural gas (24%), nuclear (20%), hydro (6%), other renewable sources (4%) and some miscellaneous minor sources.

Coal remains the dominant fuel for electricity generation, although it is gradually being supplanted by cheaper, cleaner-burning natural gas. Coal is problematic: it is relatively plentiful but has major environmental drawbacks. Eastern US coal typically has high sulfur content. Mining it creates acid drainage problems, contaminates streams and damages landscapes. Burning it creates acid rain.

The US had made good progress since the 1970’s in mitigating some of these environmental damage costs. Coal-burning power plants have smokestack scrubbers to control sulfur emissions and other pollutants. The 1990 Clean Air Act amendments included an innovative Acid Rain Program that created an auction market for SO2 emissions permits. Each year the EPA auctions allowances for about 250,000 tons of SO2 emissions. Although permit prices have exceeded $1,000/ton, they have fallen below $100/ton in recent years as generators have replaced older, dirtier systems with cleaner and more efficient systems.

Commercial electricity generation technologies exhibit significant scale economies: large power plants can generate electricity at lower cost per Kwh than small plants. So local electricity markets are usually natural monopolies: once one company installs the generating capacity and all the poles and wires to serve a community, it makes little sense for a competitor to install a duplicate system. Natural gas suppliers have similar scale economies, and tend to be natural monopolies too.

Because they are monopolies, the rates charged by electric and gas utilities are typically determined by a public regulatory agency. In Delaware, the Public Service Commission hears utilities’ requests for rate increases, and is supposed to set rates to provide a “reasonable” rate of return on utilities’ investments. Delaware also has a Public Advocate who represents the interests of consumers at PSC hearings.

Delaware now has a Renewable Portfolio Standard specifying that utilities will generate 25% of their electricity from renewable sources by 2025. While natural gas is now displacing coal because of its cost and environmental advantages, other alternative sources are also gaining.

Nuclear power was touted in the 1960’s and 70’s as the energy of the future, but its history has been tainted by some high-profile accidents: the partial meltdown and radiation release from the Three Mile Island plant in Pennsylvania in 1979; the complete meltdown of the Chernobyl reactor in the Ukraine in 1986, which contaminated large areas of the Ukraine and Belarus; and the Fukushima Daiichi meltdown in Japan that followed a major tsunami there.
While such events are rare, the potential damages are catastrophic, which makes nuclear power plants difficult to insure. In order to promote nuclear power in the US, Congress passed the Price-Anderson Nuclear Industries Indemnity Act in 1957. The current version of Price-Anderson is a sort of no-fault insurance program. The first $12.6 billion in damages would be covered by pooled industry funds, currently $375 million per generating plant. Additional damages would be covered by the federal government.

Solar power researchers are continuing to improve on the efficiencies of photovoltaics, and the federal government offers significant tax credits for solar panel installations, sometimes augmented by state subsidies. Delaware was home to AstroPower, a solar panel maker that went bankrupt, despite having the best technology at the time and a decent market share. (I lost over $10,000 on their stock!) While solar panels have a high up-front cost, subsidies can make the payback period reasonable, and they have no carbon emissions.

Delaware has also been pursuing development of an offshore wind farm. The state was in negotiations with Bluewater Wind to build an array of large wind turbines to be located 11 miles off the coast. Bluewater went bankrupt and was acquired by NRG. The current plans call for a 450 MW wind farm which could power about 100,000 homes...when the wind blows.

Solar and wind power lack the reliability to be fully autonomous systems: when the sun doesn’t shine, or the wind dies, the grid will need power from conventional sources. At the present time, this means keeping conventional generators hot all the time. One of the big technological challenges in the next decade will be integrating more efficient back-up systems into the grid, probably a combination of battery storage and instant-on generator technologies.

**Transportation**

Transportation is the second-largest energy consumption sector in the US. America invented the automobile, and it has shaped our landscape and economy in countless ways.

Americans took low gas prices for granted until the 1973 OPEC oil embargo. Although the market power of the OPEC cartel was transitory, the price shocks launched a long series of adjustments in US energy markets and policies. The US has a number of policy initiatives aimed at reducing US dependence on foreign oil.

The Strategic Petroleum Reserve was established as part of the 1975 Energy Policy and Conservation Act. The federal government has accumulated a reserve of about 700 million barrels of crude oil, equivalent to about two months of oil consumption in the US. The oil is stored in salt caverns in Texas and Louisiana. There have been occasional drawdowns for various political or economic reasons: deficit reduction, Hurricane Katrina, etc.

Congress established CAFE standards in 1978 mandating annual increases in corporate average fuel economies for passenger vehicles. A number of benefits were expected: reduced reliance on imported oil, lower gasoline prices due to reduced demand, lower automobile emissions leading to better air quality, etc. This “technology-forcing” policy did not necessarily drive the switch to more fuel-efficient cars, however. Consumers were already switching anyway in response to high gasoline prices. Japanese automakers were quick to seize much larger shares of the US automobile market; they already had fuel-efficient models in production. US auto-makers also met the CAFÉ standards, but suffered from large inventories of unsold big vehicles.

The CAFÉ standards didn’t reduce gasoline consumption or improve air quality as much as policy-makers had hoped. They reduced road mileage costs, so Americans started driving a lot more miles!

The original CAFÉ standards exempted light trucks, which came to include minivans, SUV’s, etc. About half of all US passenger vehicles are now classified as “light trucks.” The revised CAFÉ standards do include separate standards for light trucks under 8,500 pounds. Vehicle-specific standards are based on vehicle footprint (wheelbase x track).

An automaker’s aggregate CAFE is calculated from the sales-weighted harmonic mean of vehicle fuel economies. In the harmonic mean formula the w’s are sales numbers and x’s are MPG measures.

\[ \frac{\sum_{i=1}^{n} w_i}{\sum_{i=1}^{n} \frac{w_i}{x_i}} \]

Hypothesis: CAFÉ standards increased the variance of vehicle weights on the roads, tilted accident risks toward occupants of smaller vehicles. (NHTSA panel estimated about 2000 extra fatalities/year in small cars.)

In collisions between passenger cars and SUV’s, passenger car occupants had significantly higher fatality rates. Evidence that SUV owners take more driving risks; higher rates of single-vehicle accidents, including vehicle turnovers. Risk bias has been reduced due to better engineering of small cars.
Consider the perverse incentives of vehicle safety technologies such as mandatory seat belts; airbags; ABS; etc., that allow drivers to drive faster, which transfers risk to ... **pedestrians!** Armen Alchian’s proposal for highway safety: mount a large spike on every steering wheel, pointed at the driver’s heart.

The 2007 *Energy Independence and Security Act* established CAFE credit trading where vehicle manufacturers can transfer credits between categories, or sell unused credits to other manufacturers or non-manufacturers.

Bottom line: vehicle fuel economy is largely driven by gasoline prices, not by government fiat (CAFE). Similar to minimum wage laws: more symbol than substance.

Another major initiative is the use of ethanol as a gasoline additive or substitute. We have already discussed ethanol subsidies from the agricultural policy perspective. Ethanol subsidies have been a political playground for various special interests and their lobbyists.

Ethanol has been in wide use as automotive fuel in Brazil, which has a comparative advantage in sugar production and few conventional fossil fuel resources. Its adoption in the US has been driven by Congressional mandate: most retail gasoline is now required to be 15% ethanol, despite the fact that ethanol is costlier to produce than gasoline.

Approximately 40% of the US corn crop is now diverted from food to ethanol production. This has increased US food and farmland prices significantly. Even the US sucrose industry, long coddled by import quotas and guaranteed prices more than double world prices, wants a piece of the ethanol fuel subsidy pie!

The basic problem here is that rather than standing back and letting the market decide which new technologies will dominate, Congress is “picking winners and losers” in its energy policies. Using corn to power automobiles may be politically popular, but it is simply inefficient. Government subsidies attract lots of hucksters selling snake-oil (Fisker, etc.).

A smarter way to promote transportation efficiency would be to increase gasoline taxes. US motorists enjoy very low taxation of gasoline relative to other nations:

Fuel taxes function as an efficient highway **user fee** by rationing road use: Heavier vehicles with lower MPG cause more road wear and pay more fuel taxes too.

Federal gasoline taxes (in real $) are basically unchanged since 1960 (actually slightly lower): currently only **18.4 cents/gallon** gasoline, **24.4 cents/gallon** diesel. The last nominal rate change was in 1993. For gasoline retailing at $3.50/gallon, that’s only 5.5%.

State taxes range from 8 cents (AK) to 50 cents (NY), average about 30 cents. States’ political resistance to federal tax increases. Both federal and state gasoline taxes are excise taxes, meaning they are levied per quantity unit and incorporated directly into the retail price. Federal excise taxes on gasoline generate about $36 billion/year.

Gasoline excise tax revenues finance federal and state Highway Trust Funds, but fuel taxes only cover about half of highway construction and maintenance costs: Congress has to appropriate additional funds to keep the Federal HTF solvent. Costs of
deferred road construction and maintenance: faster vehicle depreciation; more congestion; higher gasoline consumption; more air pollution; more accidents & fatalities; inefficient land uses....

The price elasticity of demand for gasoline is about -0.3 in the short run (largely reduced driving), and about -0.7 in the long run (over two-thirds is improvements in vehicle fuel economy).

Critics of proposed increases in the gasoline tax argue that it would dampen economic growth. But regressing fuel taxes versus GDP/capita across nations shows a strong positive correlation.

As the Greek heating oil problem showed, heavy taxation of diesel fuel caused illegal use of less-taxed heating oil as diesel fuel. A more general tax reduces such incentives:

A carbon tax is based on the carbon content of all fossil fuels (petroleum, natural gas,...) in all uses (transportation, heating,...). This would be the most efficient way to achieve air quality objectives, including greenhouse gas goals. Al Gore has been a big proponent of this (for better or worse).

Our federal system complicates the coordination of energy policies. Politicians push for energy independence, although this isn’t likely to be economically efficient. Economic growth of China implies big increases in its share of global demand for conventional fuels.

Political debate is dominated by traditional special interests, including coal, oil & gas industries.

Coal as a legacy fuel, high-sulfur, environmentally costly. (China sitting on huge coal reserves...the coming greenhouse gas disaster?)

The US gets about 84% of its energy from fossil fuels; most of the rest is from hydro and nuclear. We have 5% of the world’s population, consume 26% of the world’s energy, and produce 26% of the world’s industrial output. Solar, wind and biofuel sources are trivial.

Royalties and Severance Taxes

The extraction of oil or gas is often taxed. A “royalty” generally refers to a tax on production from public lands, while a “severance tax” is charged on production from private lands or leases.

The US government collects royalties on oil and gas extracted offshore, within the 200-mile exclusive economic zone. States tax oil and gas extraction within their jurisdictions at various rates.

For example, Oklahoma has a graduated severance tax: 1% when crude oil is less than $14/barrel or gas less than $1.75/mcf; 4% for oil between $14 and $17/barrel or gas between $1.75 and $2.10/mcf; and 7% for oil over $17/barrel and gas over $2.10/mcf.

Royalties and severance taxes are levied on oil and gas revenues rather than resource rents or profits. A tax on resource rents will not distort a natural resource market as much as a tax on revenues, but the rents (the difference between price and marginal extraction cost) are only known to the company doing the extraction, while prices are publicly known.

Subsidies

While governments tax oil and gas production and sales, they also provide a broad array of subsidies and tax breaks to producers. Some of these are politically controversial. The US provided about $24 billion in direct energy subsidies in 2012, two-thirds of which went to renewable energy sources, including Solyndra, a solar panel manufacturer that went bankrupt. Subsidies to corn ethanol producers totaled about $6 billion.

While the fossil fuel industries no longer claim the lion’s share of these direct subsidies, they do benefit from various federal tax provisions. For example, oil and gas companies can take tax write-offs for “intangible” drilling costs ($3.5 billion in FY2012); depletion allowances on wells (treating wells like depreciating capital investments: $600 million); and domestic manufacturing deductions (for not moving wells and refineries to other countries (?!): $500 million). The Obama administration has proposed eliminating these tax breaks as part of its deficit-reduction strategy, although Congress is unlikely to do so. Of course there are countless other byzantine accounting methods, deductions, tax exemptions, etc. that energy companies and their lobbyists have run through Congress and the IRS over the years.

It is not hard to make the argument that the subsidies and tax breaks that oil and gas companies get outweigh the taxes they pay. But it all depends on what you count as subsidies and tax breaks; every business gets to deduct depreciation charges and other business expenses from its taxable income.
Big oil and gas companies are multi-national firms paying taxes at various rates in many different countries. For example, Exxon-Mobil pays about 85% of its profits on Nigerian oil to the Nigerian government, and takes US tax deductions for its foreign tax payments. In 2009, Exxon paid $15 billion in foreign taxes while receiving $150 million in US tax credits. Its 2009 after-tax profits were almost $20 billion.

“Windfall Profits” taxes

Sometimes even Congress gets offended by huge oil company profits. Thanks to OPEC and deregulation of crude oil prices in the US, the major oil companies enjoyed record-high profits in the late 1970’s. The Carter administration proposed a tax to recapture some of these “undeserved” profits. Congress passed the (mis-named) Crude Oil Windfall Profit Tax Act in 1980; it was actually an excise tax, not a tax on profits. It was repealed during the Reagan administration in 1988.

The economic rationale for a “windfall profits” tax is debatable. Oil and gas extraction are high-risk industries with boom and bust cycles: this year’s big profits may have to sustain you through next year’s big losses. Punitive taxes will certainly reduce oil company incentives to invest in developing new reserves. On the other hand, since it was really an excise tax rather than a profits tax, it actually functioned much the way a carbon tax would.